IEM's AI Modeling: Short-term COVID-19 Projections

Date: 10/4/21

Leveraging over 15 years of support to HHS for medical consequence modeling and our proprietary artificial intelligence (AI) models, IEM believes that our Coronavirus model outputs can be used to assist localities and their medical facilities to better prepare for an increase in hospitalizations, to better plan for and locate drive-through testing facilities, and to determine where increased levels of transmission may be occurring.

We have been refining our AI model over the past month and are confident in its ability to provide accurate 7-day projections that can be used for operational and logistical planning.

AI-based Model Background

IEM is currently using an AI model to fit data from various sources and project new cases of COVID-19. We do not assume the average number of secondary infections (R-value) stays the same over time. IEM's AI model finds the best R-value over time to evaluate how it changes over the course of the outbreak. The IEM modeling team is running ~11 million simulations to fit each state's data and using the best fit for the R-value to project new cases over the next 7 days. The AI models are executed on a daily basis to evaluate the changing dynamics of the COVID-19 pandemic. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

The projections shown in this document are based on data pulled in as of 10/4/21 9 a.m.

Please provide any feedback or send any questions that you might have to us. We are continually updating and improving the model, so your feedback is critical.

Also, if you have more current or refined data for your State, Commonwealth or Territory that you would like IEM to factor in, please let us know.

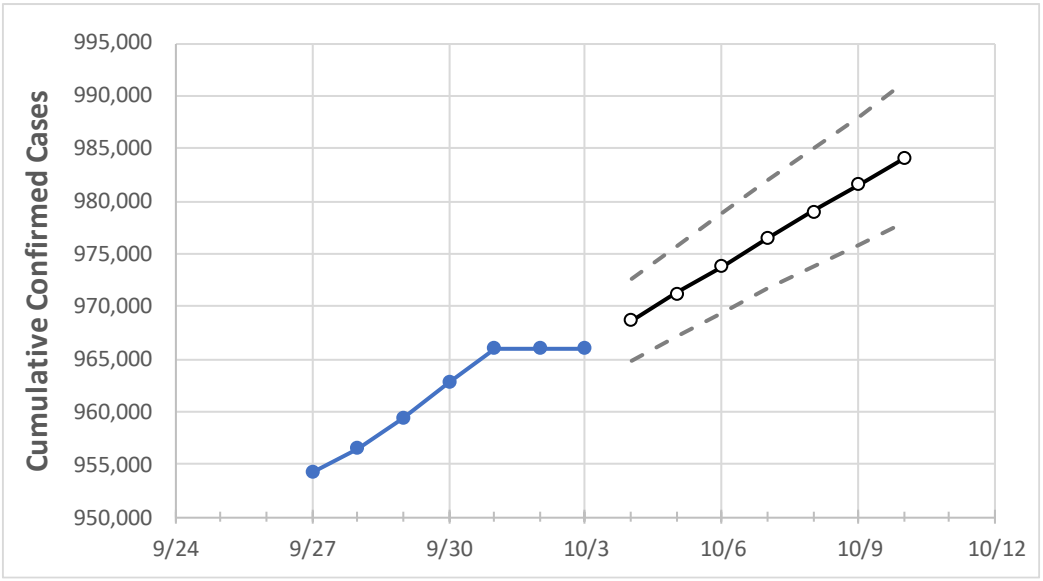
IEM's Modeling Lead

Dr. Prasith "Sid" Baccam is a **Computational Epidemiologist expert** at IEM with more than **20 years of experience in medical consequence modeling and simulation of disease outbreaks** and medical consequences following hypothetical attacks with biological agents or emerging infectious diseases. He develops key simulation models and decision support tools at IEM, specializing in public health, disaster response, and medical countermeasures (MCM) to enhance data-driven decision making and improve modeling assumptions.

Upon receiving his **Ph.D. in Applied Mathematics and Immunobiology** at Iowa State University, Dr. Baccam worked as a Postdoctoral Research Associate at Los Alamos National Laboratory where he focused on researching viral and immunological modeling. After his stint at Los Alamos, Dr. Baccam has served as Task Lead in multiple public health projects have allowed him to develop expertise as a mathematical biologist and a leader on high-performance modeling and simulation teams.

He has worked with state and local public health officials as well as Federal agencies, including **HHS**, the Centers for Disease Control and Prevention (**CDC**), and the Department of Homeland Security (**DHS**). Dr. Baccam has published numerous papers on public health response models and implications on policy and has been invited to participate in workshops and symposiums held by the Institute of Medicine (now the National Academy of Health). His modeling results have been briefed to the **Executive Office of the President** and informed two presidential policy actions.

Indiana State Projections



	Actual Confirmed Cases On:				Projected Cases For:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Indiana	962,808	965,982	965,982	965,982	968,627	971,251	973,828	976,447	979,005	981,593	984,081

Note: The State's projection shows a "best estimate" curve (the solid line with circles) and the dotted lines are the upper and lower estimates around that best estimate. Our projections have typically been within 10%, and are often within 5%, of actual confirmed cases.

Indiana Counties

	Actual Confirmed Cases On:				Projected Cases For:						
	9/30	10/1	10/2	10/3	10/4	10/5	10/6	10/7	10/8	10/9	10/10
Decatur	3,943	3,964	3,964	3,964	3,975	3,984	3,995	4,004	4,014	4,024	4,033
Hamilton	44,689	44,819	44,819	44,819	44,925	45,032	45,136	45,237	45,340	45,447	45,550
Hendricks	22,793	22,873	22,873	22,873	22,938	23,004	23,067	23,131	23,191	23,257	23,319
Johnson	24,077	24,153	24,153	24,153	24,210	24,269	24,326	24,383	24,439	24,496	24,551
Lake	64,267	64,400	64,400	64,400	64,520	64,641	64,758	64,878	64,997	65,117	65,234
Madison	17,795	17,873	17,873	17,873	17,930	17,984	18,038	18,094	18,147	18,201	18,251
Marion	130,870	131,202	131,202	131,202	131,525	131,844	132,145	132,452	132,763	133,074	133,370
St. Joseph	42,655	42,771	42,771	42,771	42,867	42,962	43,058	43,154	43,251	43,346	43,443

Some recipients of our daily COVID-19 short-term (7 day) projections have requested projections of demand for: hospital bed, intensive care unit (ICU) beds, and mechanical ventilation. We realize that different states and localities will have different characteristics for hospital demand of COVID-19 cases, and we are presenting the best assumptions we could find for those medical demands based on scientific literature and health data reporting. Specifically:

- *Beds: For hospitalization, we use a range of 10% and 20% of cases require hospitalization based on CDC's report (MMWR, March 18, 2020) and state reports of COVID-19 cases.*
- *ICU: The CDC report found that 24% of hospitalized cases require ICU care.*
- *Ventilators: Based on clinical data from China and state reports, we assume that 50% of ICU cases require a ventilator.*

If you have other estimates for these assumptions, please share them with us as we work to refine our modeling, assumptions, and data on a daily basis.

*The medical demands shown in the table assume 20% of **cumulative** confirmed cases require hospitalization. To get the medical demand for the assumption that 10% of confirmed cases require hospitalization, simply divide the demand by 2.*

Indiana Medical Demands by County

	Actual Confirmed Cases On:				Projected Cases (Hospitalized) [ICU] {Ventilator} For:		
	9/30	10/1	10/2	10/3	10/5	10/7	10/9
Decatur	3,943	3,964	3,964	3,964	3,984 (797) [191] {96}	4,004 (801) [192] {96}	4,024 (805) [193] {97}
Hamilton	44,689	44,819	44,819	44,819	45,032 (9,006) [2,162] {1,081}	45,237 (9,047) [2,171] {1,086}	45,447 (9,089) [2,181] {1,091}
Hendricks	22,793	22,873	22,873	22,873	23,004 (4,601) [1,104] {552}	23,131 (4,626) [1,110] {555}	23,257 (4,651) [1,116] {558}
Johnson	24,077	24,153	24,153	24,153	24,269 (4,854) [1,165] {582}	24,383 (4,877) [1,170] {585}	24,496 (4,899) [1,176] {588}
Lake	64,267	64,400	64,400	64,400	64,641 (12,928) [3,103] {1,551}	64,878 (12,976) [3,114] {1,557}	65,117 (13,023) [3,126] {1,563}
Madison	17,795	17,873	17,873	17,873	17,984 (3,597) [863] {432}	18,094 (3,619) [868] {434}	18,201 (3,640) [874] {437}
Marion	130,870	131,202	131,202	131,202	131,844 (26,369) [6,329] {3,164}	132,452 (26,490) [6,358] {3,179}	133,074 (26,615) [6,388] {3,194}
St. Joseph	42,655	42,771	42,771	42,771	42,962 (8,592) [2,062] {1,031}	43,154 (8,631) [2,071] {1,036}	43,346 (8,669) [2,081] {1,040}

For additional information from IEM, please contact Bryan Koon, Vice President of Emergency Management and Homeland Security at bryan.koon@iem.com or 850-519-7966 or Stephanie Tennyson at stephanie.tennyson@iem.com or 202-309-4257.